

① a) $\sqrt{6} (2\sqrt{3} - 3\sqrt{6})$

$$2\sqrt{18} - 3\sqrt{36}$$

$$2 \times \sqrt{9 \times 2} - 3 \times 6$$

$$2 \times 3\sqrt{2} - 18$$

$$\underline{\underline{6\sqrt{2} - 18}}$$

b) $\frac{3a^8 \times 6a^{-3}}{2a}$

$$2a$$

$$= \frac{18a^5}{2a^1}$$

$$\underline{\underline{9a^4}}$$

c) $2x^{\frac{1}{2}}(4x^{\frac{7}{2}} - x^{-\frac{1}{2}})$

$$8x^{\frac{1}{2} + \frac{7}{2}} - 2x^{\frac{1}{2} + (-\frac{1}{2})}$$

$$8x^4 - 2x^0$$

$$8x^4 - 2 \times 1$$

$$\underline{\underline{8x^4 - 2}}$$

d) $\sqrt{18} + 2\sqrt{27} - \sqrt{200}$

$$\sqrt{9 \times 2} + 2\sqrt{9 \times 3} - \sqrt{100 \times 2}$$

$$3\sqrt{2} + 2 \times 3\sqrt{3} - 10\sqrt{2}$$

$$3\sqrt{2} + 6\sqrt{3} - 10\sqrt{2}$$

$$6\sqrt{3} - 7\sqrt{2}$$

e) $2\sqrt{2}(\sqrt{5} + \sqrt{6})$

$$10\sqrt{4} + 2\sqrt{12}$$

$$10 \times 2 + 2 \times \sqrt{4 \times 3}$$

$$20 + 2 \times 2\sqrt{3}$$

$$\underline{\underline{20 + 4\sqrt{3}}}$$

② a) $\frac{2\sqrt{3}}{\sqrt{18}}$

$$\frac{2\sqrt{3}}{\sqrt{9 \times 2}}$$

$$\frac{2\sqrt{3}}{3\sqrt{2}}$$

$$\frac{2\sqrt{3}}{3\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$\frac{2\sqrt{6}}{3 \times \sqrt{2}}$$

$$\frac{2\sqrt{6}}{3 \times 2}$$

$$\frac{2\sqrt{6}}{6}$$

$$= \frac{\sqrt{6}}{3}$$

② b) $\frac{10}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$

$$= \frac{10\sqrt{5}}{\sqrt{25}}$$

$$= \frac{10\sqrt{5}}{5}$$

$$= \underline{\underline{2\sqrt{5}}}$$

② c) $\frac{2\sqrt{3}}{\sqrt{30}} \times \frac{\sqrt{30}}{\sqrt{30}}$

$$\frac{2\sqrt{90}}{\sqrt{30}}$$

$$\frac{2\sqrt{9 \times 10}}{\sqrt{30}}$$

$$\frac{6\sqrt{10}}{\sqrt{30}} \quad \frac{\sqrt{10}}{\sqrt{3}}$$

$$16^{-\frac{3}{4}} + \left(\frac{1}{2}\right)^0$$

$$(2^4)^{-\frac{3}{4}} + 1$$

$$2^{4 \times -\frac{3}{4}}$$

$$2^{-3}$$

$$\frac{1}{2^3} + 1$$

$$\frac{1}{8} + 1$$

$$= 1\frac{1}{8}$$

③ a) $(27)^{\frac{2}{3}}$

$$= (3^3)^{\frac{2}{3}}$$

$$= (3)^{3 \times \frac{2}{3}}$$

$$= 3^2$$

$$= \underline{\underline{9}}$$

③ b)

SURDS & INDICES.

②

④. a)

$$16^{3/4} = 2^x$$

$$(2^4)^{3/4} = 2^x$$

$$2^{\textcircled{3}} = 2^{\textcircled{x}}$$

$$\underline{\underline{x = 3}}$$

④b)

$$2^x = \sqrt{32}$$

$$2^x = (32)^{1/2}$$

$$= (2^5)^{1/2}$$

$$2^{\textcircled{x}} = 2^{\textcircled{5/2}}$$

$$\underline{\underline{x = 5/2}}$$

$$\begin{aligned}
 \textcircled{5} a) \quad & (2a-b)^2 + 4ab \\
 &= (2a-b)(2a-b) + 4ab \\
 &= 4a^2 - 4ab + b^2 + 4ab \\
 &= \underline{4a^2 + b^2}
 \end{aligned}$$

$$\begin{aligned}
 b) \quad & (3x-6)x^2 + 2x - 1 \\
 &= 3x^3 + 6x^2 - 3x - 6x^2 - 12x + 6 \\
 &= \underline{3x^3 - 15x + 6}
 \end{aligned}$$

$$\begin{aligned}
 c) \quad & 3(2x-y) - 4(x-y) \\
 &= 6x - 3y - 4x + 4y \\
 &= \underline{2x + y}
 \end{aligned}$$

$$\begin{aligned}
 d) \quad & 3a - 5b^2 \\
 &= (3a - 5b)(3a - 5b) \\
 &= \underline{9a^2 - 30ab + 25b^2}
 \end{aligned}$$

$$\begin{aligned}
 e) \quad & 6x^2 - (2x-1)(3x-2) \\
 &= 6x^2 - [6x^2 - 4x - 3x + 2] \\
 &= 6x^2 - [6x^2 - 7x + 2] \\
 &= 6x^2 - 6x^2 + 7x - 2 \\
 &= \underline{7x - 2}
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{6} a) \quad & 2x^2 - 8 \\
 &= 2(x^2 - 4) \\
 &= \underline{2(x+2)(x-2)}
 \end{aligned}$$

$$\begin{aligned}
 b) \quad & 5p^2 - 6p - 8 \\
 &= \underline{(5p + 4)(p - 2)}
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{6} c) \quad & 2xy - 8x \\
 &= \underline{2x(y - 4)}
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{6} d) \quad & 3a^2 - 12a \\
 &= \underline{3a(a - 4)}
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{6} e) \quad & 2n^2 - 18m^2 \\
 &= 2(n^2 - 9m^2) \\
 &= 2[(n)^2 - (3m)^2] \\
 &= \underline{2(n + 3m)(n - 3m)}
 \end{aligned}$$

$$\begin{aligned}
 f) \quad & 6p^2 - 7p - 3 \\
 &= \underline{(2p - 3)(3p + 1)}
 \end{aligned}$$

$$\textcircled{7} \quad a) \quad \frac{3}{2x} + \frac{1}{3x}$$

$$= \frac{9x + 2x}{6x^2}$$

$$= \frac{11x}{6x^2}$$

$$= \frac{11}{6x} \quad \text{or} \quad \frac{11}{6} x^{-1}$$

$$b) \quad \frac{2}{x^2} + \frac{3}{x}$$

$$= \frac{2x + 3x^2}{x^3}$$

$$= \frac{x(2 + 3x)}{x^3}$$

$$= \frac{2 + 3x}{x^2}$$

$$c) \quad \frac{2}{5x} - \frac{1}{3x}$$

$$\frac{6x - 5x}{15x^2}$$

$$\frac{x}{15x^2}$$

$$= \frac{1}{15x}$$

$$d) \quad \frac{3}{(6x-1)} - \frac{1}{2x}$$

$$\frac{6x - (6x-1)}{2x(6x-1)}$$

$$\frac{6x - 6x + 1}{2x(6x-1)}$$

$$\frac{1}{2x(6x-1)}$$

$$e) \quad \frac{2x^2 - 8}{x^2 + x - 6}$$

$$\frac{2(x^2 - 4)}{(x+3)(x-2)}$$

$$\frac{2(x+2)(x-2)}{(x+3)(x-2)}$$

$$\frac{2(x+2)}{(x+3)}$$

$$f) \quad \frac{4x^2 - 2x}{6x^2 + 5x - 4}$$

$$\frac{2x(2x-1)}{(2x-1)(3x+4)}$$

$$\frac{2x}{(3x+4)}$$

(5)

$$\textcircled{8} a) \quad P = 3(\textcircled{x^2} - y)$$

$$\frac{P}{3} = \textcircled{x^2} - y$$

$$\frac{P}{3} + y = x^2$$

$$\sqrt{\frac{P}{3} + y} = x$$

$$\underline{\underline{x = \sqrt{\frac{P}{3} + y}}}$$

$$b) \quad w = u + \frac{v}{\textcircled{x}}$$

$$w - u = \frac{v}{\textcircled{x}}$$

$$\textcircled{x}(w - u) = v$$

$$\underline{\underline{x = \frac{v}{w - u}}}$$

$$\textcircled{9} \quad x^2 - 8x + 5$$

$$= (x - 4)^2 - (4^2) + 5$$

$$= (x - 4)^2 - 16 + 5$$

$$\underline{\underline{(x - 4)^2 - 11}}$$

$$b) \quad x^2 + 12x - 7$$

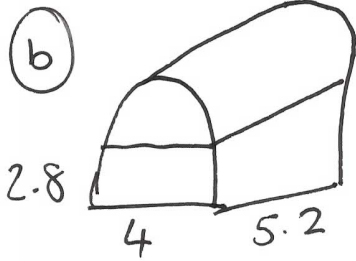
$$(x + 6)^2 - (6^2) - 7$$

$$(x + 6)^2 - 36 - 7$$

$$\underline{\underline{(x + 6)^2 - 43}}$$

Volume

10a) Can't do this no angle!



$$\begin{aligned} V_{\text{cuboid}} &= l \times b \times h \\ &= 2.8 \times 4 \times 5.2 \\ &= 58.24 \text{ m}^3 \end{aligned}$$

$$\begin{aligned} V_{\text{cylinder}} &= \pi r^2 h \\ &= \pi \times 2^2 \times 5.2 \\ &= 65.3 \end{aligned}$$

$$V = 65.3 \div 2$$

$$\begin{aligned} \text{Total } V &= 58.24 + 32.7 = 90.94 \\ &= \underline{\underline{91 \text{ m}^3}} \end{aligned}$$

11a) $V = \pi r^2 h$
 $= \pi \times 18^2 \times 42$
 $= \underline{\underline{42,729.12 \text{ cm}^3}}$

b) $V_{\text{cone}} = 42729.12 \div 200$
 $= 213.65$

$$V_{\text{cone}} = \frac{1}{3} \pi r^2 h$$
$$213.65 = \frac{1}{3} \times \pi \times r^2 \times 12$$

$$\frac{213.65}{\frac{1}{3} \pi \times 12} = r^2$$

$$r^2 = \frac{42729.12}{17.01 \dots}$$

$$r = \underline{\underline{4.1 \text{ cm}}}$$

12) $V_{\text{small}} = \pi r^2 h$
 $= \pi \times 7^2 \times 5$
 $= 769.3 \text{ cm}^3$

$$\begin{aligned} V_{\text{big}} &= \pi r^2 h \\ &= \pi \times r^2 \times 8 \\ 769.3 &= 25.12 \times r^2 \\ r^2 &= \frac{769.3}{25.12} \end{aligned}$$

$$\begin{aligned} r^2 &= 30.625 \\ &= \underline{\underline{5.5 \text{ cm}}} \end{aligned}$$

Arcs and Sectors

$$\begin{aligned}\textcircled{13a} \quad \text{Sector Area} &= \frac{x}{360} \times \pi r^2 \\ &= \frac{310}{360} \times \pi \times 18^2 \\ &= \underline{\underline{876.5 \text{ cm}^2}}\end{aligned}$$

$$\begin{aligned}\textcircled{b} \quad \text{Arc Length} &= \frac{x}{360} \times \pi d \\ &= \frac{145}{360} \times \pi \times 51 \\ &= \underline{\underline{64.5 \text{ cm}}}\end{aligned}$$

$$\begin{aligned}\text{Perimeter} &= 64.5 + 51 \\ &= \underline{\underline{115.5 \text{ cm}}}\end{aligned}$$

$$\begin{aligned}\textcircled{14} \quad \text{Arc Length} &= \frac{x}{360} \times \pi d \\ 27.5 &= \frac{x}{360} \times \pi \times 90 \\ \frac{27.5}{90\pi} &= \frac{x}{360} \times \cancel{\pi}\end{aligned}$$

$$0.097... = \frac{x}{360}$$

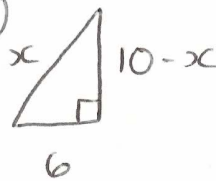
$$x = 0.097... \times 360$$

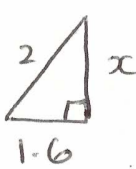
$$x = \underline{\underline{35^\circ}}$$

Angles in Shapes

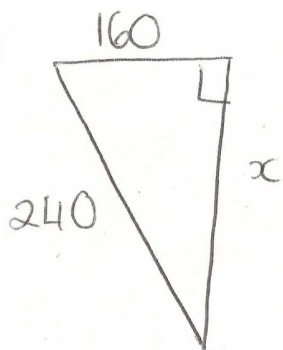
(15) $\angle PLJ = 90 - 31 = 59^\circ$
 $\angle PLK = 90 - 62 = 28^\circ$
 $\angle KLJ = 59 + 28 = \underline{\underline{87^\circ}}$

(16) $\angle OTQ = 90 - 27 = 63^\circ$
 $\angle OQT = 63^\circ$
 $\angle TOQ = 180 - (63 + 63)$
 $= 180 - 126$
 $= \underline{\underline{54^\circ}}$
 $\angle OPT = 90 - 54$
 $= \underline{\underline{36^\circ}}$

(17) 
 $a^2 = b^2 + c^2$
 $x^2 = (10-x)^2 + 6^2$
 $x^2 = 100 + x^2 - 20x + 36$
 $0 = 136 - 20x$
 $20x = 136$
 $x = \underline{\underline{6.8\text{cm}}}$

(18) 
 $a^2 = b^2 + c^2$
 $x^2 = 2^2 + 1.6^2$
 $x^2 = 1.44$
 $x = \underline{\underline{1.2}}$
 $\text{height} = 1.2 + 2$
 $= \underline{\underline{3.2\text{m}}}$

(19)



$$x^2 = 240^2 - 160^2$$

$$x^2 = 32000$$

$$x = \sqrt{32000}$$

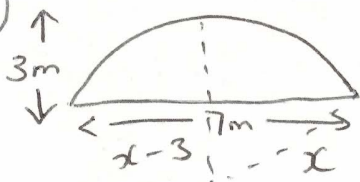
$$x = 178.885$$

$$h = 240 - 178.885$$

$$= 61.115 \text{ m}$$

$$= \underline{\underline{61.1 \text{ m}}}$$

(20)



$$a^2 = b^2 + c^2$$

$$x^2 = (x-3)^2 + 3.5^2$$

$$x^2 = x^2 - 6x + 9 + 12.25$$

$$0 = -6x + 9 + 12.25$$

$$6x = 21.25$$

$$x = 3.5$$

$$OB = \underline{\underline{3.5 \text{ m}}}$$

Scientific Notation

$$21. \quad 2.55 \times 10^8 \div (365 \times 24 \times 60) = 4.85 \times 10^2$$

$$22. \quad \text{AU/ps} = 3.08 \times 10^{13} \div 1.49599 \times 10^8 \\ = 2.06 \times 10^5 \text{ AU per Parsec}$$

$$23 \text{ a) } 1.47 \times 10^8 = 147,000,000$$

$$\text{b) Land mass of USA} = \frac{103}{360} \times 1.47 \times 10^8 \\ = 4.21 \times 10^7 \text{ km}^2$$

Fractions and Percentages

(24a)

$$\begin{aligned}\frac{1}{2} + \frac{2}{3} \div 1\frac{1}{5} &= \frac{1}{2} + \frac{2}{3} \times \frac{5}{6} \\&= \frac{1}{2} + \frac{5}{9} \\&= \frac{9}{18} + \frac{10}{18} \\&= \frac{19}{18} \text{ or } 1\frac{1}{18}\end{aligned}$$

$$\begin{aligned}\textcircled{b} \quad \frac{5}{6} + \left(1\frac{1}{2}\right)^2 &= \frac{5}{6} + \left(\frac{3}{2}\right)^2 \\&= \frac{5}{6} + \frac{9}{4} \\&= \frac{10}{12} + \frac{27}{12} \\&= \frac{37}{12} \\&= \underline{\underline{3\frac{1}{12}}}\end{aligned}$$

$$\begin{aligned}\textcircled{c} \quad \frac{5}{6} \div \left(1\frac{1}{2} + 1\frac{1}{3}\right) &= \frac{5}{6} \div \left(\frac{3}{2} + \frac{4}{3}\right) \\&= \frac{5}{6} \div \left(\frac{9}{6} + \frac{8}{6}\right) \\&= \frac{5}{6} \div \left(\frac{17}{6}\right) \\&= \frac{5}{6} \times \frac{6}{17} \\&= \underline{\underline{\frac{5}{17}}}\end{aligned}$$

$$\begin{aligned}
 24) d) \frac{3}{4} \text{ of } \left(1\frac{1}{3} - \frac{5}{6}\right) &= \frac{3}{4} \times \left(\frac{4}{3} - \frac{5}{6}\right) \\
 &= \frac{3}{4} \times \left(\frac{8}{6} - \frac{5}{6}\right) \\
 &= \frac{3}{4} \times \frac{3}{6} \\
 &= \frac{3}{4} \times \frac{1}{2} \\
 &= \underline{\underline{\frac{3}{8}}}
 \end{aligned}$$

$$25) \frac{4}{9} \text{ of } 1260$$

$$\begin{array}{r} 140 \\ 9 \overline{) 1260} \end{array}$$

$$140 \times 4 = \underline{\underline{560 \text{ girls}}}$$

$$\text{or } \frac{5}{9} \text{ of } 1260$$

$$\begin{array}{r} 140 \\ 9 \overline{) 1260} \end{array} \quad 140 \times 5 = 700$$

$$1260 - 700 = \underline{\underline{560 \text{ girls}}}$$

$$\begin{aligned}
 26) a) \quad 10\% &= 48 \\
 5\% &= 24 \\
 30\% &= 144 \\
 35\% &= \underline{\underline{\pounds 168}}
 \end{aligned}$$

$$\begin{aligned}
 b) \text{ Saves: } 35\% & \quad \pounds 168 \\
 \text{Mum: } 10\% \left(\frac{1}{10}\right) & \quad \pounds 48 \\
 & \quad \underline{\pounds 216}
 \end{aligned}$$

$$\text{Spends: } 480 - 216 = \underline{\underline{\pounds 264}}$$

$$\begin{aligned}
 27) a) \quad 1 \text{ year} &= \frac{2400}{100} \times 6.2 \\
 &= \pounds 148.80
 \end{aligned}$$

$$\begin{aligned}
 12 \text{ months} &= 148.8 \\
 \div 12 & \quad \div 12 \\
 1 \text{ month} &= 12.4 \\
 \times 8 & \quad \times 8 \\
 8 \text{ months} &= \underline{\underline{\pounds 99.20}}
 \end{aligned}$$

$$b) \frac{100+12}{100} = 1.12$$

$$\begin{aligned}
 6500 \times 1.12^4 &= 10227.8758 \\
 &= \underline{\underline{\pounds 10227.88}}
 \end{aligned}$$

$$\begin{aligned}
 c) \frac{100-4.5}{100} &= 0.955 \quad 32000 \times 0.955^5 = 25419.4902 \\
 &= \underline{\underline{\pounds 25419.49}}
 \end{aligned}$$

$$d) \frac{135}{1250} \times 100 = \underline{\underline{10.8\%}}$$

$$28) \quad a) \quad 35000 - 32200 = 2800$$

$$\frac{2800}{35000} \times 100 = \underline{\underline{8\%}}$$

$$b) \quad 32200 \times 0.92^3 = 25073.7536 \\ = \underline{\underline{\pounds 25073.75}}$$

$$29) \quad \begin{array}{l} 135\% = 405\text{ml} \\ \div 135 \quad \quad \quad \div 135 \\ 1\% = 3\text{ml} \\ 100\% = \underline{\underline{300\text{ml}}} \end{array}$$

$$30) \quad 15000 - 13200 = 1800$$

$$\frac{1800}{15000} \times 100 = 12\% \text{ decrease}$$

After 5 more years:

$$\frac{100-12}{100} = 0.88$$

$$13200 \times 0.88^5 \\ = 6966.06 \\ = \underline{\underline{6966 \text{ buffalo}}}$$

Similarity

$$31.(a) SF = \frac{10}{7}$$

$$AC \times \frac{10}{7} = AE$$

$$\frac{10}{7} AC = AC + 6$$

$$10 AC = 7AC + 42$$

$$3AC = 42$$

$$AC = \underline{\underline{14 \text{ cm}}}$$

$$(b) . SF = \frac{20}{15} = \frac{4}{3}$$

$$BC \times \frac{4}{3} = AC$$

$$24 \times \frac{4}{3} = x + 24$$

$$32 = x + 24$$

$$x = \underline{\underline{8 \text{ cm}}}$$

$$32(a) . LSF = \frac{60}{30} = 2$$

$$\Rightarrow ASF = 2^2 = 4$$

$$\begin{aligned} \text{Larger Mirror} &= 4 \times 2600 \text{ cm}^2 \\ &= \underline{\underline{10400 \text{ cm}^2}} \end{aligned}$$

$$(b) . LSF = \frac{12}{18} = \frac{2}{3}$$

$$\Rightarrow VSF = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$$

$$\begin{aligned} \text{Smaller Balloon} &= \frac{8}{27} \times 1350 \text{ cm}^3 \\ &= \underline{\underline{400 \text{ cm}^3}} \end{aligned}$$

Straight line

33e) $m = \frac{0 - (-2)}{8 - 0}$
 $= \frac{2}{8}$
 $= \frac{1}{4}$
 $y = \frac{1}{4}x - 2$

34a) $m = \frac{8 - 0}{6 - 2}$
 $= \frac{8}{4}$
 $= 2$

b) $y - 0 = 2(x - 2)$
 $y = 2x - 4$

35. $x + 5y = 16$ — ①
 $5x - 2y = -1$ — ②

① $\times 2$ $2x + 10y = 32$

② $\times 5$ $25x - 10y = -5$

ADD $27x = 27$
 $x = 1$

sub $x = 1$ into ①

$1 + 5y = 16$

$5y = 15$

$y = 3$

$(1, 3)$

b) $A \in (-12, a)$

$a = \frac{1}{4} \times -12 - 2$
 $= -3 - 2$
 $= -5$

c) $-12 \neq 2 \times -5 - 4$

\therefore does not lie on the line

d) $3m = 2m - 4$
 $m = -4$